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[continued on next page]

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Patent Application

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FILTER ELEMENT

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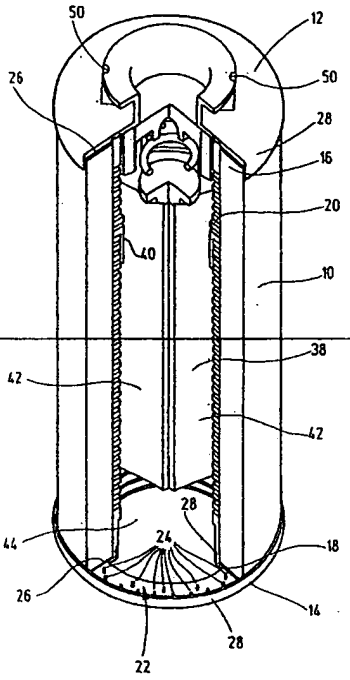

(57) Abstract: The invention relates to a filter element comprising a filter medium (10) extending between two end caps (12, 14) that are respectively connected to an associable end region (16, 18) of the filter medium (10), supported at least on one side on a supporting tube (20). The fact that at least one of the end caps (14) and/or at least one end region (16, 18) of the filter medium (10) comprises a contacting device (22) and/or the respective end cap (14) itself or parts thereof are embodied in such a way as to derive the electrostatic charges especially occurring during the operation of the filter element, ensures that the charge generated on the filter medium (Meshpack) by tribo-electrical effects can escape towards a mass point or a mass site via the contacting device (22) or the respective end cap (14).

(57) Zusammenfassung: Die Erfindung betrifft ein Filterelement mit einem Filtermedium (10), das sich zwischen zwei Endkappen (12, 14) erstrekt, die jeweils mit einem zuordenbaren Endbereich (16, 18) des Filtermediums (10) verbunden sind, das sich zumindest an einem Seite an einem Stützrohr (20) abstützt. Dadurch, dass mindestens eine der Endkappen (14) und/oder zumindest ein Endbereich (16, 18) des Filtermediums (10) eine Kontaktierungseinrichtung (22) aufweist und/oder die jeweilige Endkappe (14) selbst oder Teile von ihr ableitend ausgebiltet sind, zwecks Ableiten der, insbesondere im Betrieb des Filterelements auftretenden, elektrostatischen Aufladungen, ist sichergestellt, dass die durch tribo-elektrische Effekte am Filtermedium (Mescpack) generierte Ladung über die Kontaktierungseinrichtung (22) oder die jeweilige Endkappe (14) an einen Massepunkt oder Massestelle abfliessen kann.

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~~Filter Element~~

FIELD OF THE INVENTION

The present invention relates to a filter element comprising a filter medium~~, which extends~~ extending between two end caps ~~which are each~~. Each end cap is connected to one assignable end area of the filter medium~~, which is~~ supported at least on one side on a support tube.

BACKGROUND OF THE INVENTION

Filter elements of ~~the aforementioned~~this type are conventional, and are widely used, for example, in hydraulic systems in system branches through which hydraulic oils flow. The known filter elements are not entirely satisfactory with respect to their operating reliability and the stability of the beta value which is decisive for filter performance. In particular, for high flow rates there is the danger that at the connecting site ~~at which~~where the ends of the filter mat web are combined into a ring body ~~which forms~~ forming the filter cylinder, deformations or damage will occur due to the differential fluid pressure ~~which is~~ active at the connecting site. These adverse effects and/or deformations of the folds in the area of the connecting site are generally termed "buckling of the folds" in the technical terminology.

To counteract this problem, for example, in the DE 102 50 969 A1 ~~which was~~ published at a later date, it was suggested that the sequence of folds for the filter medium of the filter element be selected such that each fold ~~which extends~~extending over the entire radial extension of the intermediate space from the outer jacket surface to the inner support tube is followed by one fold with a radially inside fold back located at a distance from the inner support tube of the element~~,~~ and ~~which is~~ followed in turn by a fold ~~which extends~~extending over the entire radial extension of the intermediate space. This yields improved beta value stability, even at high flow rates.

Furthermore, in the known solutions the structure of the filter media and filter elements can vary greatly from manufacturer to manufacturer. For simple paper elements, the filter mats are made as filter media without supporting wire gauze~~, and at~~. At higher differential pressures on the filter elements, the filter folds can be pressed together. This pressing results in the drainage

possibility for folded mats being reduced ~~so that accordingly~~ with many folds ~~remain~~ remaining unused for filtration. Conversely, higher quality elements have a multilayer mat structure for the filter medium, for modern filter media a six- and more layer structure indeed being possible, for example, in the form of a succession of following layers; an outer support, a protective nonwoven layer, a prefilter layer, a main filter layer, a support nonwoven layer, and an inner support. Moreover, when the filter material is a filter mat web built up in several layers as described above, they have an outer support ~~which forms~~forming the outer jacket surface in the form of a lattice or gauze structure. This can be a polyamide- or polyester-based structure and alternatively the multilayer filter mat web can have a metallic grating as the support ~~which forms~~forming the outer jacket surface. The respective filter medium ~~which is~~ built up in several layers is also termed a mesh pack in the technical terminology~~, and generally~~. Generally the dirty fluid flows through it in one direction (often in general from the outside to the inside), with the dirty components remaining in the filter medium.

To make the filter element stable under pressure, ~~provision is moreover made such that in~~ the interior ~~there is~~has a support tube, preferably of plastic material~~, which~~ and provided with perforations ~~supports~~supporting the filter medium against the intended flow direction. The two end caps between which the filter medium, and if necessary the plastic support tube extends, are likewise made preferably from plastic materials~~, especially the~~. Especially, the plastic support tube is made as an injection molded part. Since the filter medium ~~for fixing with the end caps~~ is generally cemented to ~~them~~ the end caps in the area of ~~its~~ the filter medium free ends, the cement used, often in the form of an epoxy resin cement, produces a type of insulating layer between the inserted filter medium, the two end caps, and/or the support tube~~, the~~. The insulating effects ~~being~~ are further intensified by the support tube being preferably made longer than the actual filter medium (mesh pack), so that forces cannot act on it in the longitudinal direction. If this application of force cannot be avoided, it is possible that as a result of the compressive stresses ~~which occur~~occurring when the fluid flows through the filter medium the ~~latter~~ filter medium is damaged and in this way then adequate filtration performance can no longer be ensured.

The indicated insulation structure, due to the insulating layers between the filter medium, the end caps, and the support tube, can cause electrostatic charging especially of the filter medium when fluid passes with dirt which may be present on the filter medium. Due to the potential differences ~~which are~~ produced in this way, within the filter element discharges can suddenly occur between statically charged filter element parts, especially in the form of the filter medium and electrically conductive components, especially in the form of the generally metallic filter housing in which the filter element is held~~, with the~~. The result is that electrostatic discharges occur~~; this~~. This electrostatic discharge must be considered critical with respect to the combustibility of the media to be filtered, such as hydraulic oil, heavy oil fuels such as diesel fuels or the like~~, and the indicated~~. The electrostatic discharges can also lead to damage of the oil and of the sensitive filter medium material.

~~On the basis of this prior art, the~~BACKGROUND OF THE INVENTION

An object of the present invention is to ~~further improve the known~~provide improved filter elements while maintaining their advantages, specifically high operating reliability and high beta value stability, even at high flow rates on the medium to be filtered such that especially in operation of the filter element no potential differences can occur between parts of the filter element ~~which lead~~leading to electrostatic discharges.

This object is basically achieved by a filter element ~~with the features specified in claim 1 in its entirety.~~

~~In that, as specified in the characterizing part of claim 1,~~where at least one of the end caps and/or at least one end area of the filter medium has a contact-making means and/or the respective end cap itself or parts of it are made dissipative~~, for~~. For purposes of dissipating the electrostatic charges ~~which occur~~occurring especially in filter element operation by ~~means of~~ the fluid medium, it is ensured that the charge ~~which is~~ generated by triboelectric effects on the filter medium (mesh pack) can drain by ~~way of the~~ contact-making means or the respective end cap to a ground point, for example, formed from metallic housing parts in which the filter element can be held with formation of a filter device. As a result of this dissipation, voltage peaks within the filter element are avoided,

with their adverse result that spark discharges can occur which could damage the filter element itself.

In one preferred embodiment of the filter element ~~as claimed in the~~of the present invention, ~~provision is made such that~~ the contact-making means ~~consists of~~comprises conductive contact elements which penetrate a cement bed (epoxy resin cement) ~~which forms~~forming a type of insulating layer between the end cap and the end area of the filter medium accommodated by this end cap~~, and in this way~~ to come into dissipative contact with the filter medium. Preferably ~~it is furthermore provided that~~, the conductive contact elements ~~consist of~~ are contact pins ~~which make~~ making contact with the mesh pack with their one free end in the cement bed~~,~~ and in the area of the other free end ~~stand~~standing vertically upright on the respective~~ly assignable~~ end cap. With this solution, the insulating layer ~~consisting~~ of the cement bed is bridged by contact elements in the form of contact pins, with the ~~latter~~ pins being dimensioned such that in any case the thickness of the cement bed and production tolerances for the filter medium (mesh pack) for dissipating the charge potential are reliably penetrated. The charge prevailing in the filter medium can ~~thus~~ then drain by ~~way of~~ this end cap to the housing as the ground point via the dissipative pins ~~which are~~ preferably injected together with the O-ring-shaped cap as the end cap of the filter medium~~, and breakdown~~. Breakdown of the charge with spark formation within the element is then reliably prevented ~~in this way~~.

In another preferred embodiment of the filter element ~~as claimed in the~~of the present invention, ~~to form the dissipative end cap or its parts,~~ plastics with a conductivity additive, conductive coatings, or intrinsically conductive plastics are used~~.~~ to form the dissipative end cap or its parts. High quality steel fibers, aluminum flakes, metal-coated glass fibers, or carbon fibers including conductive carbon black are especially well suited as conductivity additives for ~~so-called~~ filled plastics. Dissipative coatings can be applied galvanically or by high vacuum vapor deposition, by painting with conductive enamel or by ~~means of~~ flame, arc or plasma spaying. Furthermore, the application of nanolayers is conceivable here. Intrinsically conducting polymers (ICP) are plastics in which conductivity is achieved by doping. Plastics ~~which are~~ suitable for this purpose are especially polyacetylene, polypyrrole, polythiophene and polyaniline.

In another preferred embodiment of the filter element ~~as claimed in~~of ~~the~~the present invention, the respective end cap has annular surfaces projecting to the inside and outside, between which the assignable end area of the filter medium fits~~, and the~~. The annular surfaces accommodate the contact-making means not only between themselves, but are also used as a lateral stop for the cement as soon as it is added to the end cap for a connecting process.

In another preferred embodiment of the filter element ~~as claimed in the~~of the present invention, at least that end cap with the contact-making means has a connecting part~~,~~ for fixing the filter element in a filter housing~~,~~ and a sealing means, especially in the form of an O-ring ~~which is~~ located between the filter housing and the end cap of the filter element, ~~being~~ made dissipative. Due to the dissipative O-ring the filter element with its front surface need not necessarily be pressed against the housing ~~which surrounds~~surrounding the filter element ~~in order in this way~~ to produce the necessary dissipative contact. Rather ~~then~~, in addition or alternatively, a version of the filter element can be conceivable with a dissipative O-ring to discharge the potential difference.

Other ~~advantageous embodiments~~objects, advantages and salient features of the ~~filter element as claimed in the invention are the subject matter of the dependent claims.~~

~~The filter element as claimed in the~~ present invention will ~~be~~become apparent from the following detailed ~~below using one exemplary~~description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment ~~as shown in~~of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings~~. The figures~~ which form a part of this disclosure and which are schematic and not to scale~~.~~:

FIG. 1 ~~shows in~~is a perspective view, a partially cutaway ~~state a longitudinal view~~ of ~~the~~ a filter element~~.~~ according to one exemplary embodiment of the present invention; and

FIG. 2 ~~shows~~is a ~~longitudinal~~side elevational view in section through the filter element ~~as~~ shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

The filter element ~~as claimed in the~~according to the exemplary embodiment of the present invention has a filter medium 10 ~~which extends~~extending between the two, first and second end caps 12, 14 ~~which are~~with each end cap connected to an assignable first or second end area 16, 18 of the filter medium 10 ~~which~~. The filter medium is otherwise supported on ~~the~~ its inner peripheral side on a support tube 20. ~~Viewed~~ As viewed in ~~the direction of looking at~~ FIG. 1, the lower or first end cap 14 has a contact-making means ~~which is identified as a whole as~~or contact maker 22 for dissipating an electrostatic charge ~~which occurs~~occurring in operation of the filter element in particular.

The contact-making means 22 ~~consists of~~includes individual conductive contact elements, in particular in the form of individual contact pins 24 ~~which extend~~extending through a cement bed 26 forming a type of insulating layer between the end cap 14 and the accommodated end region 18 of the filter medium 10~~, and in this way~~ to make dissipative contact with the filter medium 10. ~~In this regard therefore the~~ The contact pins 24 penetrate the cement bed 26, and ~~otherwise they~~ stand vertically upright on the respective~~ly assignable~~ end cap 14 in the area of ~~their~~pin other free end~~.~~s. This configuration can be provided fundamentally on the ~~two~~upper and lower end caps 14, 16~~; but placement~~. Placement on only ~~on~~ one end cap is adequate ~~in order in this way~~ to ensure dissipation by ~~way of~~ this end cap 14 with the ground points of the housing (not shown) in which the filter element can be held with the formation of a filter device.

As is to be seen in particular from the ~~cutaway in~~ longitudinal section of FIG. 2, the filter medium 10 can be built up as a multilayer filter mat, for example, with six layers~~, and the~~. The layers ~~which~~ follow each other in succession, and have the following:

- an outer support, a protective nonwoven layer, a prefilter layer, a main filter layer, a support nonwoven layer, and an inner support~~, for~~. For the outer support, a polyamide lattice or a polyester

fabric ~~being~~ is possible. The inner support of the filter mat can be supported on the outer periphery of the fluid-permeable support tube 20 or can be formed by this support tube 20 itself.

Since for reasons of weight and recycling, it is a good idea to build up the entire filter element from plastic materials~~, this~~. This forming is accompanied by the problem of increasingly static charging as arises when the fluid to be filtered, for example, as in this case from the outside to the inside, flows through the filter medium 10. In these cases ~~then~~ within the plastic filter element, potential or charge differences arise with the result that when a definable charge difference is exceeded, sparkover or breakdown with the corresponding electrostatic discharge occurs. Since fundamentally the medium to be filtered is combustible, there is a risk in operation with pure plastic filter elements. Conversely, based on the contact-making means 22 with the contact pins 24, it is possible to discharge the potential differences ~~and charges which occur~~. Charges occurring by ~~way of~~ the end caps, especially the lower end cap 14, discharge into the ground point ~~which is~~ formed by the housing~~, and statically~~. Statically relevant potential differences in addition to a electrostatic discharge are thus reliably avoided.

The ~~filter medium 10 as shown in the figures is~~ illustrated filter medium 10 has a cylindrical filter mat~~; but the~~. The possibility also exists of making the individual filter mat layers pleated along a cylindrical periphery ~~in order~~ to increase the effective filter surface. A filter mat structure is also possible as is indicated in DE 102 50 969 A1 ~~which was~~ published at a later date. When the filter medium 10 is ~~being~~ built up with its individual layers, it ~~however~~ should preferably be ~~watched that they consist~~ made of correspondingly dissipative plastic materials. As is furthermore to be seen from FIG. 1 in particular, the respective end cap 12, 14 to the inside and outside is provided with one projecting annular surface 28 each~~, which~~. Surfaces 28 integrate the cement bed 26 ~~between themselves.~~therebetween. Between the two annular surfaces 28 of the lower end cap 14 ~~in turn~~, the individual contact pins 24 extend in a parallel longitudinal alignment to the longitudinal axis 30 of the filter element. The conductive contact elements or contact pins 24 can ~~consist~~ be made of metal~~; but~~. Preferably, they are ~~preferably~~ made from a conductive plastic material which can be injected jointly with the end cap 14 in one working cycle.

~~Furthermore, the~~The respective end cap 14 with the contact-making means 22 can have a connecting part 32 (~~compare~~ FIG. 2) for fixing the filter element in a filter housing (not shown~~),~~ ~~one~~). One sealing means or seal 34, for example, in the form of a conventional O-ring ~~which~~, is located between the filter housing and one end cap 14 of the filter element, ~~being~~ and is made dissipative. Generally this O-ring would not have to be dissipative, since the filter element with its front surface 36 is pressed against the seating part of the filter housing by which conductive contact occurs. Accordingly it would however also be possible to effect the pertinent discharging via the O-ring of the sealing means 34 if the O-ring ~~consists~~ is made of dissipative material or is coated in this way. As is furthermore to be seen from FIG. 1, the contact pins 24 are configured in concentric circles to the longitudinal axis 30 of the filter element within the end cap 14, the imaginary circle ~~which runs~~extending outermost has more contact pins 24 than the inner circle.

~~As is furthermore to be seen from the figures, within~~ Within the support tube 20 along its ribs ~~which border~~bordering the fluid passage sites, a separating segment 38 is suspended or clipped accordingly at the connecting point 40~~, the~~. The individual separating walls 42 of this segment 38 ~~enabling~~enables flow guidance within the filter element, in the direction of the penetration site 44 in the area of the lower end cap 14. In an extension to the top, the separating segment 38 has a plate-like closing body 48 ~~which is~~ actuated by a compression spring 46 and ~~which assumes~~assuming the bypass function ~~such that when~~. When the filter medium 10 is clogged, the uncleaned fluid can enter the interior of the filter element 10 via diametrically opposite entry points 50 in the upper end cap ~~region~~ 12, to flow through the filter element 10 and emerge in the direction of the lower penetration site 44~~, and the~~. The bypass function can be adjusted in terms of its triggering behavior by ~~way of~~ the definable spring force of the compression spring 46.

The ~~indicated~~ contact-making means 22 need not be limited to one solution in which the contact pins of one end cap or the end caps 12, 14 in the cement bed 26 make contact with the mesh pack~~, but it would also be conceivable for the~~. The necessary contact ~~to~~can also be made via conductive mat webs in the form of a gauze or the like into which the cement penetrates. It would also be conceivable from the sides of the filter medium 10 to produce a conductive connection to the dissipative end cap areas, for example, by corresponding wire or platinum connections (not shown).

With the ~~solution as claimed in the~~present invention, it is in any case possible, even for pure plastic elements or for those filter elements which are made primarily of plastic materials, to reliably address the problem of static charging in addition to electrostatic discharge, without the modification having an adverse effect on the pressure stability values, beta values, filtration performance, etc.

As an alternative or in addition to the described contact-making means 22 ~~however~~, the respective end cap 14 itself or parts of it can also be made dissipative. To form the dissipative end cap 14 or its parts, plastics with a conductivity additive, conductive coatings or intrinsically conductive plastics are especially well suited. High quality steel fibers, aluminum flakes, metal-coated glass fibers, carbon fibers, ~~but also~~ and conductive carbon black are well suited as conductivity additives for ~~so-called~~ filled plastics. Dissipative coatings can be applied galvanically or by ~~means of~~ high vacuum vapor deposition, by painting with conductive enamel, or by flame, arc or plasma spaying. ~~Furthermore,~~ The application of nanolayers is also conceivable here. Intrinsically conducting polymers (ICP) are obtained preferably by doping, with the following plastics being considered especially well suited for this purpose: polyacetylene, polypyrrole, polythiophene and polyaniline. This list does not include all the plastics that may be considered well suited for said purpose.

While one embodiment has been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

FILTER ELEMENT

ABSTRACT OF THE DISCLOSURE

A filter element includes a filter medium (10) extending between two end caps (12, 14) that are respectively connected to an associable end region (16, 18) of the filter medium (10). The filter medium is supported at least on one side on a supporting tube (20). At least one of the end caps (14) and/or at least one end region (16, 18) of the filter medium (10) has a contacting device (22) and/or the respective end cap (14) itself or its parts are embodied in such a way as to derive the electrostatic charges, especially occurring during the operation of the filter element to ensure that the charge generated on the filter medium (Meshpack) by tribo-electrical effects can escape towards a mass point or a mass site via the contacting device (22) or the respective end cap (14).

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(54) **Elektrisch leitfähiges Filter.**

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an einer Stelle mit einem elektrisch leitfähigen Teil 10 der Filterpatrone verbunden sind. Anstelle mehrerer Zugfedern 9 kann eine einzige ausreichend sein, wenn sie sich nur auf der einen Stirnseite des Filterelementes über alle Faltenstirnseiten erstreckt.

Patentansprüche

1. Elektrisch leitfähiges Filter mit einem zick-zack-förmig gefalteten bahnförmigen Filtermaterial, das auf zumindest einer,Seite eine elektrisch leitfähige Oberflächenschicht auf einem nicht leitfähigen Grundmaterial aufweist und das an seinen Faltenstirnseiten in einem elektrisch leitfäfhigen Rahmen (5) über Dichtmaterial gefaßt ist, dadurch **gekennzeichnet,** daß an zumindest einer Faltenstirnseite das Dichtmaterial (4) elektrisch leitfähig ist.

2. Filter nach Anspruch 1, dadurch **gekennzeichnet,** daß das elektrisch leitfähige Dichtmaterial lediglich eine linienförmige den Rahmen (5) und zumindest einen Bereich jeder Falte (6) verbindende Schicht (7) ist, während sich hieran elektrisch nichtleitendes Dichtmaterial (8) anschließt.

3. Filter nach dem Oberbegriff des Anspruchs 1, dadurch **gekennzeichnet,** daß das Filtermaterial (1) in seiner Bahnenlängsrichtung mit einem die leitfähige Oberflächenschicht kontaktierenden linien- oder streifenförmigen biegsamen leitfähigen Zusatzmaterial (2, 3, 9) leitfähig verhunden ist.

4. Filter nach Anspruch 3, dadurch **gekennzeichnet,** daß das Zusatzmaterial (2, 3) auf der noch ungefalteten Filtermaterialbahn (1) aufgebracht ist.

5. Filter nach Anspruch 3, dadurch **gekennzeichnet,** daß das linien- oder streifenförmige Zusatzmaterial mit in dessen Längsrichtung federnd bzw. elastisch wirkenden Elementen versehen ist oder aus solchen zusammengesetzt ist, zwischen denen die einzelnen Falten einklemmbar sind bzw. zwischen welchen diese Elemente entsprechend einklemmbar sind.

6. Filter nach einem der Ansprüche 3 oder 5, dadurch **gekennzeichnet,** daß das Zusatzmaterial eine Zugfeder (9) ist, die an einer Stirnseite der Falten so auf die einzelnen Falten aufklemmbar ist, daß eine an den Faltenkanten aufgebrochene leitfähige Oberflächenschicht in Längsrichtung des Filterbahnmaterials (1) elektrisch leitend verbunden ist.

Claims

1. Electrically conductive filter with a web-form filter material which is folded in a zig-zag manner, has an electrically conductive surface layer on at least one side on a non-conductive base material and, on its fold end faces, is set in an electrically conductive frame (5) via sealing material, characterised in that the sealing material (4) is electrically conductive at least at one fold end face.

2. Filter according to claim 1, characterised in that the electrically conductive sealing material is merely a linear layer (7) connecting the frame (5) and at least a region of each fold (6) while electrically non-conductive sealing material (8) is attached hereto.

3. Filter according to the preamble of claim 1, characterised in that the filter material (1) is conductively connected in its longitudinal web direction to a linear or strip-shaped flexible conductive additional material (2, 3, 9) contacting the conductive surface layer.

4. Filter according to claim 3, characterised in that the additional material (2, 3) is applied on the still unfolded web of filter material (1).

5. Filter according to claim 3, characterised in that the linear or strip-shaped additional material is provided with elements which act resiliently or elastically in the longitudinal direction thereof or is composed of such elements, between which the individual folds can be gripped or between which these elements can accordingly be gripped.

6. Filter according to one of claims 3 or 5, characterised in that the additional material is a tension spring (9) which can be clamped onto the individual folds at one end face of the folds such that a conductive surface layer broken open at the fold edges is connected electrically conductively in the longitudinal direction of the filter web material (1).

Revendications

1. Filtre électriquement conducteur, comprenant une matière filtrante en forme de bande pliée en zigzag laquelle est munie au moins sur l'une des faces d'une couche superficielle électriquement conductrice appli-

an einer Stelle mit einem elektrisch leitfähigen Teil 10 der Filterpatrone verbunden sind. Anstelle mehrerer Zugfedern 9 kann eine einzige ausreichend sein, wenn sie sich nur auf der einen Stirnseite des Filterelementes über alle Faltenstirnseiten erstreckt.

Patentansprüche

1. Elektrisch leitfähiges Filter mit einem zick-zack-förmig gefalteten bahnförmigen Filtermaterial, das auf zumindest einer,Seite eine elektrisch leitfähige Oberflächenschicht auf einem nicht leitfähigen Grundmaterial aufweist und das an seinen Faltenstirnseiten in einem elektrisch leitfäfhigen Rahmen (5) über Dichtmaterial gefaßt ist, dadurch **gekennzeichnet,** daß an zumindest einer Faltenstirnseite das Dichtmaterial (4) elektrisch leitfähig ist.

2. Filter nach Anspruch 1, dadurch **gekennzeichnet,** daß das elektrisch leitfähige Dichtmaterial lediglich eine linienförmige den Rahmen (5) und zumindest einen Bereich jeder Falte (6) verbindende Schicht (7) ist, während sich hieran elektrisch nichtleitendes Dichtmaterial (8) anschließt.

3. Filter nach dem Oberbegriff des Anspruchs 1, dadurch **gekennzeichnet,** daß das Filtermaterial (1) in seiner Bahnenlängsrichtung mit einem die leitfähige Oberflächenschicht kontaktierenden linien- oder streifenförmigen biegsamen leitfähigen Zusatzmaterial (2, 3, 9) leitfähig verhunden ist.

4. Filter nach Anspruch 3, dadurch **gekennzeichnet,** daß das Zusatzmaterial (2, 3) auf der noch ungefalteten Filtermaterialbahn (1) aufgebracht ist.

5. Filter nach Anspruch 3, dadurch **gekennzeichnet,** daß das linien- oder streifenförmige Zusatzmaterial mit in dessen Längsrichtung federnd bzw. elastisch wirkenden Elementen versehen ist oder aus solchen zusammengesetzt ist, zwischen denen die einzelnen Falten einklemmbar sind bzw. zwischen welchen diese Elemente entsprechend einklemmbar sind.

6. Filter nach einem der Ansprüche 3 oder 5, dadurch **gekennzeichnet,** daß das Zusatzmaterial eine Zugfeder (9) ist, die an einer Stirnseite der Falten so auf die einzelnen Falten aufklemmbar ist, daß eine an den Faltenkanten aufgebrochene leitfähige Oberflächenschicht in Längsrichtung des Filterbahnmaterials (1) elektrisch leitend verbunden ist.

Claims

1. Electrically conductive filter with a web-form filter material which is folded in a zig-zag manner, has an electrically conductive surface layer on at least one side on a non-conductive base material and, on its fold end faces, is set in an electrically conductive frame (5) via sealing material, characterised in that the sealing material (4) is electrically conductive at least at one fold end face.

2. Filter according to claim 1, characterised in that the electrically conductive sealing material is merely a linear layer (7) connecting the frame (5) and at least a region of each fold (6) while electrically non-conductive sealing material (8) is attached hereto.

3. Filter according to the preamble of claim 1, characterised in that the filter material (1) is conductively connected in its longitudinal web direction to a linear or strip-shaped flexible conductive additional material (2, 3, 9) contacting the conductive surface layer.

4. Filter according to claim 3, characterised in that the additional material (2, 3) is applied on the still unfolded web of filter material (1).

5. Filter according to claim 3, characterised in that the linear or strip-shaped additional material is provided with elements which act resiliently or elastically in the longitudinal direction thereof or is composed of such elements, between which the individual folds can be gripped or between which these elements can accordingly be gripped.

6. Filter according to one of claims 3 or 5, characterised in that the additional material is a tension spring (9) which can be clamped onto the individual folds at one end face of the folds such that a conductive surface layer broken open at the fold edges is connected electrically conductively in the longitudinal direction of the filter web material (1).

Revendications

1. Filtre électriquement conducteur, comprenant une matière filtrante en forme de bande pliée en zigzag laquelle est munie au moins sur l'une des faces d'une couche superficielle électriquement conductrice appli-

quée sur un matériau de base non conducteur et dont les faces frontales des plis sont montées par l'intermédiaire d'un matériau d'étancheité dans un cadre (5) électriquement conducteur, **caractérisé en ce** que le matériau d'étancheité (4) est électriquement conducteur sur au moins l'une des faces frontales des plis.

2. Filtre selon la revendication 1, caractérisé en ce que le matériau d'étanchéité électriquement conducteur n'est qu'une couche (7) linéaire reliant le cadre (5) et au moins une section de chaque plis (6), à laquelle fait suite du matériau d'étancheité électriquement non conducteur (8).

3. Filtre selon le préambule de la revendication 1, caractérisé en ce que la matière filtrante (1) est reliée, dans le sens longitudinale de ses bandes, à un matériau supplémentaire (2, 3, 9) souple et conducteur, linéaire ou en forme de bande, qui établit le contact électrique avec la couche superficielle conductrice.

4. Filtre selon la revendication 3, caractérisé en ce que le matériau supplémentaire (2, 3) est appliqué sur la bande de matière filtrante (1) pas encore pliée.

5. Filtre selon la revendication 3, caractérisé en ce que le matériau supplémentaire linéaire ou en forme de bande est muni d'éléments agissant à la manière d'un ressort et respectivement élastiquement dans la direction de son extension longitudinale ou qu'il est constitué de tels éléments entre lesquels peuvent être serrés les différents plis et respectivement entre lesquels, ces éléments peuvent être serrés de manière analogue.

6. Filtre selon l'une des revendications 3 ou 5, caractérisé en ce que le matériau supplémentaire est un ressort de traction (9) qui peut être coincé sur l'une des faces frontales des plis de telle façon qu'une couche superficielle conductrice rompue aux bords des plis est reliée de manière électriquement conductrice dans le sens longitudinal de la matière filtrante (1) en bande.

Fig. 1

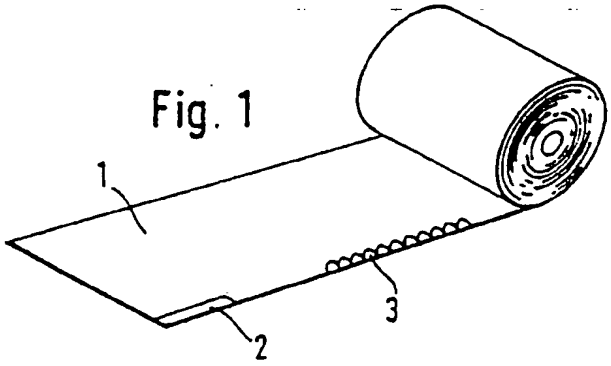
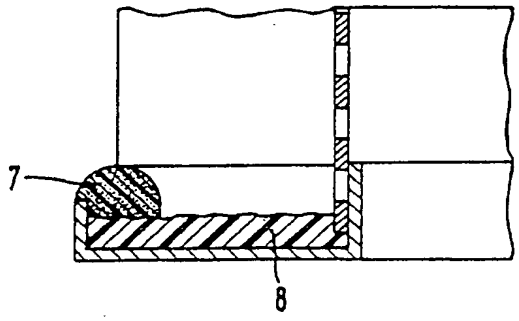


Fig. 3



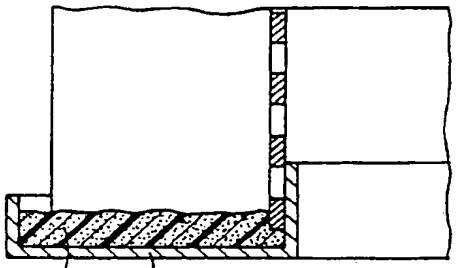


Fig. 2a

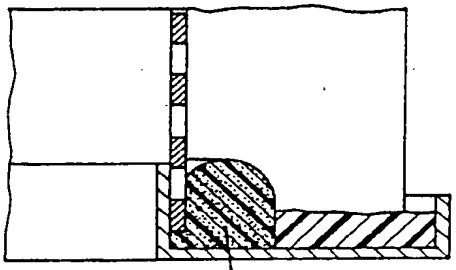


Fig. 2b

Fig. 4